CLAIMS

1. A tensioning system for use in joint repair surgery comprising:

a plurality of breakaway guide pins adapted for attachment to a patient's bone and including one or more notches or grooves that facilitate preferential breakage of the guide pins at or near the notches or grooves; and

a tensioning device comprising:

an attachment portion comprising a plurality of attachment posts, each configured to slidably attach to one of said breakaway guide pins; and

a tensioning portion configured to independently apply a desired tensile load to at least two separate strands of a soft tissue graft, the tensioning portion comprising:

a first adjustable tensioning apparatus configured so as to selectively increase or decrease a first tensile load applied to a first strand of a soft tissue graft; and

a second adjustable tensioning apparatus configured so as selectively increase or decrease a second tensile load applied to a second strand of the soft tissue graft independently of the first tensile load applied by the first adjustable tensioning apparatus.

2. A tensioning system as defined in claim 1, wherein the breakaway guide pins are designed to be used only once and then discarded.

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60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

3. A tensioning system as defined in claim 1, each attachment post further comprising a hollow portion adapted to slidably receive therein one of the guide pins.

4. A tensioning system as defined in claim 1, each of the first and second adjustable tensioning apparatus comprising:

a tensioning piston adapted to receive and secure thereto one or more sutures attached to at least one soft tissue graft strand;

a hollow cylinder slidably disposed around at least a portion of the tensioning piston; and

a spring disposed within the hollow cylinder and communicating between the hollow cylinder and tensioning piston so as to increase the tensile load applied by the tensioning piston onto the soft tissue graft strand as the spring is compressed.

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5. A tensioning system as defined in claim 4, the tensioning piston further comprising a suture attachment wheel rotatably attached thereto.

6. A tensioning system as defined in claim 4, further comprising a tensioning bolt in threadable communication with the hollow cylinder so that selective rotation of the tensioning bolt causes corresponding movement of the hollow cylinder relative to the tensioning bolt.

7. A tensioning system as defined in claim 1, further comprising one or more tensile load gauges that display the tensile load applied by each of the first and second tensioning apparatus.

8. A tensioning system as defined in claim 1, wherein the attachment portion and the tensioning portion are non-removably joined together.

9. A tensioning system as defined in claim 1, further comprising at least one suture strand separator configured for removable attachment to the tensioning device and adapted to maintain at least two suture strands attached to different ends of a multi-strand tissue graft in a desired space-apart relationship

10. A tensioning system as defined in claim 1, further comprising a tension calculator adapted for determining what portion of a total tensile load to be applied to a composite tissue graft is to be applied to each tissue graft strand individually.

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11. A tensioning system for use in joint repair surgery comprising:

a tensioning device comprising:

an attachment portion configured to removably attach the tensioning device to a person's limb; and

a tensioning portion configured to independently apply a desired tensile load to at least two separate strands of a soft tissue graft, the tensioning portion comprising:

a first adjustable tensioning apparatus configured so as to selectively increase or decrease a first tensile load applied to a first strand of a soft tissue graft; and

a second adjustable tensioning apparatus configured so as selectively increase or decrease a second tensile load applied to a second strand of the soft tissue graft independently of the first tensile load applied by the first adjustable tensioning apparatus; and

at least one suture strand separator configured for removable attachment to the tensioning device and adapted to maintain at least two suture strands attached to different ends of a multi-strand tissue graft in a desired space-apart relationship.

12. A tensioning system as defined in claim 11, the suture strand separator comprising a gripping head and a chiseled end opposite the gripping head that facilitates insertion of the suture strand separator between two or more suture strands.

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60 EAST SOUTH TEMPLE
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13. A tensioning system as defined in claim 11, the suture strand separator comprising a first retention recess adapted to receive a first suture strand or group of suture strands and a second retention recess adapted to receive a second suture strand or group of suture strands, the first and second retention recesses being spaced-apart so as to maintain the first and second suture strands or groups of suture strands in the desired spaced-apart relationship.

14. A tensioning system as defined in claim 11, the suture strand separator comprising a pair of spaced-apart guide recesses adapted to mate with corresponding attachment posts within the attachment portion of the tensioning device.

15. A tensioning system as defined in claim 14, the tensioning system comprising two suture strand separators that are adapted to separate four suture strands or groups of suture strands into four spaced-apart quadrants.

16. A tensioning system as defined in claim 15, the two suture strand separators together defining a central recess through which an interference screw can be inserted to affix a soft tissue graft to a bone tunnel when the tensioning system is in use.

17. A tensioning system as defined in claim 11, further comprising a tension calculator adapted for determining what portion of a total tensile load to be applied to a composite tissue graft is to be applied to each tissue graft strand individually.

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18. A method for repairing a patient's joint, comprising:

removing at least two soft tissue strands from the patient's body;

doubling over the soft tissue strands to form looped tissue graft bundles, each having a doubled-over end and two free ends opposite the doubled over end, the looped tissue graft bundles together comprising a composite tissue graft;

attaching the doubled-over end of each looped tissue graft bundle to a first bone of the patient's joint while leaving the free ends of each looped tissue graft bundle initially unaffixed to a second bone of the patient's joint;

applying a first tensile load to the free ends of a first looped graft bundle in manner so that the first tensile load is equalized between the free ends of the first graft bundle;

applying a second tensile load to the free ends of a second looped graft bundle independently from the first tensile load and in manner so that the second tensile load is equalized between the free ends of the second graft bundle;

affixing the composite tissue graft to the second bone of the patient's joint after conditioning and pre-tensioning each looped graft bundle.

19. A method as defined in claim 18, further comprising attaching one or more suture strands to each free end of the lopped graft bundles.

20. A method as defined in claim 18, wherein one of the soft tissue strands comprises a semitendinosus tendon and another of the soft tissue strands comprises a gracillis tendon, the tendons being used to repair an anterior cruciate ligament.

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21. A method as defined in claim 18, wherein the composite tissue graft is conditioned by independently applying a corresponding conditioning load to each tissue graft bundle and then repeatedly flexing and extending the joint.

22. A method as defined in claim 21, wherein the multi-strand tissue graft is pre-tensioned after conditioning is complete by independently adjusting the conditioning load applied to each tissue graft bundle to a final tension.

23. A method as defined in claim 21, wherein the final tension applied to at least one of the tissue graft bundles is less than the corresponding conditioning load.

24. A method as defined in claim 18, further comprising determining what portion of a total tensile load to be applied to the composite tissue graft is to be applied to each looped graft bundle individually based on the relative diameters of the looped graft bundles.

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